

Application. No.: 10/757,265  
Filing Date: January 14, 2004  
Response dated July 25, 2006  
Reply to Office Communication of June 26, 2006

### **COMPLETE LISTING OF CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application:

#### **Listing of Claims:**

1.-62. (Canceled)

63. (new) A method of designing a direct expansion geothermal heat exchange system comprising providing an R-410A refrigerant.

64. (new) The method of claim 63, further comprising providing a polyolester oil for use in conjunction with a direct expansion system utilizing an R-410A refrigerant.

65. (new) The method of claim 63, further comprising providing a single piston metering device in the heating mode, with the following pin restrictor (Aeroquip type) sizing, based on central hole bore size in inches, utilized, plus or minus a maximum of two (2) one thousandths of an inch (0.001) central hole bore size, within the following depth ranges:

Maximum Heating Tonnage Design.....Pin Restrictor Central Bore Hole Size  
In Inches

\*0 to 50feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.041 |
| 2.....    | 0.049 |
| 2.5.....  | 0.055 |
| 3.....    | 0.059 |
| 3.5.....  | 0.063 |
| 4.....    | 0.065 |
| 4.5.....  | 0.068 |
| 5.....    | 0.071 |

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\*51 to 175 feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.039 |
| 2.....    | 0.047 |
| 2.5.....  | 0.052 |
| 3.....    | 0.056 |
| 3.5.....  | 0.060 |
| 4.....    | 0.062 |
| 4.5.....  | 0.065 |
| 5.....    | 0.067 |

\*176 to 300 feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.037 |
| 2.....    | 0.044 |
| 2.5.....  | 0.050 |
| 3.....    | 0.053 |
| 3.5.....  | 0.057 |
| 4.....    | 0.059 |
| 4.5.....  | 0.061 |
| 5.....    | 0.064 |

66. (new) The method of claim 63, further comprising providing, in the cooling mode, a self-adjusting thermostatic expansion valve which is located proximate to the interior air handler and is sized at 140%, plus or minus 10% of 100%, of the maximum compressor tonnage design capacity in the cooling mode;

providing an optional single piston metering device, situated proximate to the interior air handler in the cooling mode, with the following pin restrictor (Aeroquip type) sizing, based on central hole bore size in inches, utilized, plus or minus a maximum of two (2) one thousandths of an inch (0.001) central hole bore size, within the following depth ranges:

Maximum Cooling Tonnage Design - Pin Restrictor Bore Size In Inches  
\*0 to 50 feet (height of interior air handler above the compressor unit)

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|           |       |
|-----------|-------|
| 1.5 ..... | 0.058 |
| 2.....    | 0.070 |
| 2.5.....  | 0.077 |
| 3.....    | 0.085 |
| 3.5.....  | 0.093 |
| 4.....    | 0.099 |
| 4.5.....  | 0.100 |
| 5.....    | 0.112 |

67. (new) The method of claim 63, further comprising providing a charging of the refrigerant system in the cooling mode until the peak operational efficiency is reached and the superheat is within the 10 to 25 degree F range, the head pressure is within the 305 to 405 PSI range, the liquid head pressure is within the 195 to 275 PSI range, which is similar to the head pressure range in the heating mode, the suction pressure is within the 80 to 160 PSI range, and the suction/vapor temperature is within the 37 degree to 55 degree F. temperature range.

68. (new) A method of designing a direct expansion geothermal heat exchange system comprising providing a refrigerant with heating/cooling operational working pressures between 80 psi and 405 psi.

69. (new) The method of claim 68, further comprising providing an R-410A refrigerant.

70. (new) The method of claim 68, further comprising providing a polyolester oil for use in conjunction with a direct expansion system comprising providing a refrigerant with heating/cooling operational working pressures between 80 psi and 405 psi.

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71. (new) The method of claim 68, further comprising providing a single piston metering device in the heating mode, with the following pin restrictor (Aeroquip type) sizing, based on central hole bore size in inches, utilized, plus or minus a maximum of two (2) one thousandths of an inch (0.001) central hole bore size, within the following depth ranges:

Maximum Heating Tonnage Design.....Pin Restrictor Central Bore Hole Size  
In Inches

\*0 to 50feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.041 |
| 2.....    | 0.049 |
| 2.5.....  | 0.055 |
| 3.....    | 0.059 |
| 3.5.....  | 0.063 |
| 4.....    | 0.065 |
| 4.5.....  | 0.068 |
| 5.....    | 0.071 |

\*51 to 175 feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.039 |
| 2.....    | 0.047 |
| 2.5.....  | 0.052 |
| 3.....    | 0.056 |
| 3.5.....  | 0.060 |
| 4.....    | 0.062 |
| 4.5.....  | 0.065 |
| 5.....    | 0.067 |

\*176 to 300 feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.037 |
| 2.....    | 0.044 |
| 2.5.....  | 0.050 |
| 3.....    | 0.053 |
| 3.5.....  | 0.057 |
| 4.....    | 0.059 |
| 4.5.....  | 0.061 |
| 5.....    | 0.064 |

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72. (new) The method of claim 68, further comprising providing, in the cooling mode, a self-adjusting thermostatic expansion valve which is located proximate to the interior air handler and is sized at 140%, plus or minus 10% of 100%, of the maximum compressor tonnage design capacity in the cooling mode;

providing an optional single piston metering device, situated proximate to the interior air handler in the cooling mode, with the following pin restrictor (Aeroquip type) sizing, based on central hole bore size in inches, utilized, plus or minus a maximum of two (2) one thousandths of an inch (0.001) central hole bore size, within the following depth ranges:

| Maximum Cooling Tonnage Design   | - | Pin Restrictor Bore Size In Inches |
|--|---|------------------------------------|
| *0 to 50 feet (height of interior air handler above the compressor unit) |   |                                    |
| 1.5 .....  |   | 0.058                              |
| 2.....   |   | 0.070                              |
| 2.5.....   |   | 0.077                              |
| 3.....   |   | 0.085                              |
| 3.5.....   |   | 0.093                              |
| 4.....   |   | 0.099                              |
| 4.5.....   |   | 0.100                              |
| 5.....   |   | 0.112                              |

73. (new) The method of claim 68, further comprising providing a charging of the refrigerant system in the cooling mode until the peak operational efficiency is reached and the superheat is within the 10 to 25 degree F range, the head pressure is within the 305 to 405 PSI range, the liquid head pressure is within the 195 to 275 PSI range, which is similar to the head pressure range in the heating mode, the

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suction pressure is within the 80 to 160 PSI range, and the suction/vapor temperature is within the 37 degree to 55 degree F. temperature range.

74. (new) A direct expansion geothermal heat exchange system comprising providing an R-410A refrigerant.

75 (new) The system of claim 74, further comprising providing a polyolester oil for use in conjunction with a direct expansion system utilizing an R-410A refrigerant.

76. (new) The system of claim 74, further comprising providing a single piston metering device in the heating mode, with the following pin restrictor (Aeroquip type) sizing, based on central hole bore size in inches, utilized, plus or minus a maximum of two (2) one thousandths of an inch (0.001) central hole bore size, within the following depth ranges:

Maximum Heating Tonnage Design.....Pin Restrictor Central Bore Hole Size  
In Inches

\*0 to 50feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.041 |
| 2.....    | 0.049 |
| 2.5.....  | 0.055 |
| 3.....    | 0.059 |
| 3.5.....  | 0.063 |
| 4.....    | 0.065 |
| 4.5.....  | 0.068 |
| 5.....    | 0.071 |

\*51 to 175 feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.039 |
| 2.....    | 0.047 |
| 2.5.....  | 0.052 |
| 3.....    | 0.056 |
| 3.5.....  | 0.060 |

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|          |       |
|----------|-------|
| 4.....   | 0.062 |
| 4.5..... | 0.065 |
| 5.....   | 0.067 |

\*176 to 300 feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.037 |
| 2.....    | 0.044 |
| 2.5.....  | 0.050 |
| 3.....    | 0.053 |
| 3.5.....  | 0.057 |
| 4.....    | 0.059 |
| 4.5.....  | 0.061 |
| 5.....    | 0.064 |

77. (new) The system of claim 74, further comprising providing, in the cooling mode, a self-adjusting thermostatic expansion valve which is located proximate to the interior air handler and is sized at 140%, plus or minus 10% of 100%, of the maximum compressor tonnage design capacity in the cooling mode;

providing an optional single piston metering device, situated proximate to the interior air handler in the cooling mode, with the following pin restrictor (Aeroquip type) sizing, based on central hole bore size in inches, utilized, plus or minus a maximum of two (2) one thousandths of an inch (0.001) central hole bore size, within the following depth ranges,

Maximum Cooling Tonnage Design - Pin Restrictor Bore Size In Inches

\*0 to 50 feet (height of interior air handler above the compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.058 |
| 2.....    | 0.070 |
| 2.5.....  | 0.077 |
| 3.....    | 0.085 |
| 3.5.....  | 0.093 |
| 4.....    | 0.099 |

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4.5.....0.100  
5.....0.112

78. (new) The system of claim 77, further comprising providing a charging of the refrigerant system in the cooling mode until the peak operational efficiency is reached and the superheat is within the 10 to 25 degree F range, the head pressure is within the 305 to 405 PSI range, the liquid head pressure is within the 195 to 275 PSI range, which is similar to the head pressure range in the heating mode, the suction pressure is within the 80 to 160 PSI range, and the suction/vapor temperature is within the 37 degree to 55 degree F. temperature range.

79. (new) A direct expansion geothermal heat exchange system comprising providing a refrigerant with heating/cooling operational working pressures between 80 psi and 405 psi.

80. (new) The system of claim 79, further comprising providing an R-410A refrigerant.

81. (new) The system of claim 79, further comprising providing a polyolester oil for use in conjunction with a direct expansion system comprising providing a refrigerant with heating/cooling operational working pressures between 80 psi and 405 psi.

82. (new) The system of claim 79, further comprising providing a single piston metering device in the heating mode, with the following pin restrictor (Aeroquip type) sizing, based on central hole bore size in inches, utilized, plus or minus a



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maximum of two (2) one thousandths of an inch (0.001) central hole bore size,  
within the following depth ranges,

Maximum Heating Tonnage Design.....Pin Restrictor Central Bore Hole Size  
In Inches

\*0 to 50feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.041 |
| 2.....    | 0.049 |
| 2.5.....  | 0.055 |
| 3.....    | 0.059 |
| 3.5.....  | 0.063 |
| 4.....    | 0.065 |
| 4.5.....  | 0.068 |
| 5.....    | 0.071 |

\*51 to 175 feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.039 |
| 2.....    | 0.047 |
| 2.5.....  | 0.052 |
| 3.....    | 0.056 |
| 3.5.....  | 0.060 |
| 4.....    | 0.062 |
| 4.5.....  | 0.065 |
| 5.....    | 0.067 |

\*176 to 300 feet (depth of borehole below compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.037 |
| 2.....    | 0.044 |
| 2.5.....  | 0.050 |
| 3.....    | 0.053 |
| 3.5.....  | 0.057 |
| 4.....    | 0.059 |
| 4.5.....  | 0.061 |
| 5.....    | 0.064 |

83. (new) The system of claim 79, further comprising providing, in the cooling mode, a self-adjusting thermostatic expansion valve which is located proximate to

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the interior air handler and is sized at 140%, plus or minus 10% of 100%, of the maximum compressor tonnage design capacity in the cooling mode;

providing an optional single piston metering device, situated proximate to the interior air handler in the cooling mode, with the following pin restrictor (Aeroquip type) sizing, based on central hole bore size in inches, utilized, plus or minus a maximum of two (2) one thousandths of an inch (0.001) central hole bore size, within the following depth ranges,

Maximum Cooling Tonnage Design - Pin Restrictor Bore Size In Inches

\*0 to 50 feet (height of interior air handler above the compressor unit)

|           |       |
|-----------|-------|
| 1.5 ..... | 0.058 |
| 2.....    | 0.070 |
| 2.5.....  | 0.077 |
| 3.....    | 0.085 |
| 3.5.....  | 0.093 |
| 4.....    | 0.099 |
| 4.5.....  | 0.100 |
| 5.....    | 0.112 |

84. (new) The system of claim 79, further comprising providing a charging of the refrigerant system in the cooling mode until the peak operational efficiency is reached and the superheat is within the 10 to 25 degree F range, the head pressure is within the 305 to 405 PSI range, the liquid head pressure is within the 195 to 275 PSI range, which is similar to the head pressure range in the heating mode, the suction pressure is within the 80 to 160 PSI range, and the suction/vapor temperature is within the 37 degree to 55 degree F. temperature range.